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10/589,003	08/10/2006	Tadashi Itoh	1035-646	4549

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EXAMINER	
LEE, JAE	

ART UNIT	PAPER NUMBER
2823	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/589,003	Applicant(s) ITOH ET AL.	
	Examiner JAE LEE	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 07 March 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,4-8,10-12 and 16-19 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,4-8,10-12,16-19 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/07/2008 has been entered.

Allowable Subject Matter

2. The indicated allowability of **claims 13-15** are withdrawn in view of the newly discovered reference(s) to Yamada et al. (USP# 5,249,250, hereinafter Yamada et al.). Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

1. **Claims 1,4-8,10-12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Williams et al. in view of Yakshin et al. and further in view of Taniguchi et al. and further in view of Yamada et al.

With regards to **claim 1**, Williams et al. teaches a group I-VII semiconductor crystal thin film formed on a substrate made from ionic crystals,

The group I-VII semiconductor crystal thin film being formed on a buffer layer while a beam is irradiated on the group I-VII semiconductor crystal thin film, the buffer layer being for alleviating distortion caused due to a difference in lattice constant between the substrate and the group I-VII semiconductor crystal film (see Experimental Procedure, ¶1, lines 13-16, buffer layer CaF_2 serves as structural template, Results and Discussion, ¶2, lines 1-3).

Williams et al., however, does not teach the beam to be an electron beam.

In the same field of endeavor, Yakshin et al. teaches how electron beam evaporation allows the user to selectively control the energy contribution at every stage of the film growth (see ¶9, lines 6-7).

Williams et al., however, teaches the semiconductor film to be single crystal (see Fig. 3).

In the same field of endeavor, Taniguchi et al. provides motivation for making the CuCl layer single crystal by teaching how a single crystal structure will have better electron mobility than a polycrystalline crystal structure which would make the semiconductor film more effective in operation (see ¶7, lines 1-3).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create single crystal semiconductor films since electron mobility would be greatly enhanced as compared to a polycrystalline structure.

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

Williams et al. also does not teach the acceleration voltage HV of the electron beam is $0(kv) < HV < 30(kv)$.

In the same field of endeavor, Yamada et al. teaches a process wherein the electron beam's acceleration voltage is 15kv, well within the range of 0 to 30 kv. Primarily, such a low amount of kv is used to prevent breakdown of the growing film which can potentially destroy the device (see col. 9, lines 47-56).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to utilize an electron beam with an acceleration voltage of 15 kv in order to prevent the breakdown of films as taught by Yamada et al.

With regards to **claim 5**, the combination of Williams et al., Yashkin et al., and Taniguchi et al. teaches the group I-VII semiconductor single crystal thin film as set forth in **claim 1**, wherein:

A region formed while irradiating an electron beam thereon and a region formed while not irradiating the electron beam thereon are located different places when viewing the substrate in a direction vertical to its surface (see Yashkin et al., see ¶37, lines 1-5, 6-14, different techniques will deposit on different locations of the surface).

With regards to **claim 6**, the combination of Williams et al., Yashkin et al., and Taniguchi et al. teaches the group I-VII semiconductor single crystal thin film as set forth in **claim 1** being a CuCl thin film (see Williams et al., Experimental Procedure, lines 13-16).

With regards to **claim 7**, the combination of Williams et al., Yashkin et al., and Taniguchi et al. teaches the group I-VII semiconductor single crystal thin film as set forth in **claim 1** being a metal halide semiconductor thin film (see Williams et al., Experimental Procedure, lines 13-16).

With regards to **claim 8**, Williams et al. teaches a process for producing a group I-VII semiconductor crystal thin film on a substrate made from ionic single crystals, comprising:

forming a buffer layer on the substrate, the buffer layer being for alleviating distortion caused due to a difference in lattice constant between the substrate and the group I-VII semiconductor crystal thin film (see Results and Discussion, ¶2, lines 1-3; buffer layer CaF_2 serves as structural template); and

forming, on the buffer layer, the group I-VII semiconductor crystal thin film, the group I-VII semiconductor thin film being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see Experimental Procedure, ¶1, lines 13-16).

Williams et al., however, does not teach the beam to be an electron beam.

In the same field of endeavor, Yakshin et al. teaches how electron beam evaporation allows the user to selectively control the energy contribution at every stage of the film growth (see ¶9, lines 6-7).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to utilize an electron beam evaporation since it allows the user to selectively control the energy contribution at every stage of the film growth.

Williams et al., however, teaches the semiconductor film to be single crystal (see Fig. 3).

In the same field of endeavor, Taniguchi et al. provides the motivation for using single crystal film by teaching how a single crystal structure will have better electron mobility than a polycrystalline crystal structure which would make the semiconductor film more effective in operation (see ¶7, lines 1-3).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create single crystal semiconductor films since electron mobility would be greatly enhanced as compared to a polycrystalline structure.

Williams et al. does not teach the single crystal thin film to be of single composition.

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

Williams et al. also does not teach the acceleration voltage HV of the electron beam is $0(kv) < HV < 30(kv)$.

In the same field of endeavor, Yamada et al. teaches a process wherein the electron beam's acceleration voltage is 15kv, well within the range of 0 to 30 kv. Primarily, such a low amount of kv is used to prevent breakdown of the growing film which can potentially destroy the device (see col. 9, lines 47-56).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to utilize an electron beam with an acceleration voltage of 15 kv in order to prevent the breakdown of films as taught by Yamada et al.

With regards to **claim 10**, the combination of Williams et al., Yashkin et al., and Taniguchi et al. teaches the process as set forth in **claim 8**, comprising:

forming a layer of the group I-VII semiconductor single crystal thin film while irradiating an electron beam thereon; and

forming the rest of the group I-VII semiconductor single crystal thin film while not irradiating the electron beam thereon (see Yashkin et al., see ¶37, lines 1-5, 6-14).

With regards to **claim 11**, the combination of Williams et al., Yashkin et al., and Taniguchi et al. teaches the process as set forth in **claim 9**, wherein:

the layer formed while irradiating the electron beam thereon and the layer formed while not irradiating the electron beam thereon have film thicknesses that are decided in consideration of a film thickness of the group I-VII semiconductor single crystal thin film, which is the combination of the layer formed while irradiating the electron beam thereon and the layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5; layer can also be formed without electron beam such as sputtering and magnetron sputtering, see ¶37, lines 6-14, film thickness of entire thin film must be considered to determine the thicknesses of the individual layers).

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

With regards to **claims 4,12**, the combination of Williams et al., Yakshin et al., and Taniguchi et al. teaches the limitations of **claims 1,8** for the reasons above.

The combination, however, does not teach the group I-VII semiconductor single crystal thin film as set forth having a film thickness that allows an internal electric field to be resonance-increased.

In the same field of endeavor, it would have been obvious to one of ordinary skill to determine the optimum film thickness to allow an electric field to be resonance-increased (see *In re Aller, Lacey, and Hall* (10 USPQ 233-237). It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon

particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical (see *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990)).

With regards to **claim 16**, Williams et al. teaches a group I-VII semiconductor crystal thin film formed on a substrate made from ionic crystals,

The group I-VII semiconductor crystal thin film being formed on a buffer layer while a beam is irradiated on the group I-VII semiconductor crystal thin film, the buffer layer being for alleviating distortion caused due to a difference in lattice constant between the substrate and the group I-VII semiconductor crystal film (see Experimental Procedure, ¶1, lines 13-16, buffer layer CaF_2 serves as structural template, Results and Discussion, ¶2, lines 1-3).

Williams et al., however, does not teach the beam to be an electron beam.

In the same field of endeavor, Yakshin et al. teaches how electron beam evaporation allows the user to selectively control the energy contribution at every stage of the film growth (see ¶9, lines 6-7).

Williams et al., however, teaches the semiconductor film to be single crystal (see Fig. 3).

In the same field of endeavor, Taniguchi et al. provides motivation for making the CuCl layer single crystal by teaching how a single crystal structure will have better electron mobility than a polycrystalline crystal structure which would make the semiconductor film more effective in operation (see ¶7, lines 1-3).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create single crystal semiconductor films since electron mobility would be greatly enhanced as compared to a polycrystalline structure.

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

Williams et al., however, does not teach the filament current FI of the electron beam to be 0(A) < FI < 5(A).

In the same field of endeavor, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to understand that if the irradiation current was 1 mA as taught by Yamada et al. (see **claims 17,19**), then the filament current MUST be no greater than 1 mA since one of ordinary skill would recognize that the current of the filament must be no greater than the irradiation current of the device.

With regards to **claim 17**, Williams et al. teaches a group I-VII semiconductor crystal thin film formed on a substrate made from ionic crystals,

The group I-VII semiconductor crystal thin film being formed on a buffer layer while a beam is irradiated on the group I-VII semiconductor crystal thin film, the buffer layer being for alleviating distortion caused due to a difference in lattice constant between the substrate and the group I-VII semiconductor crystal film (see Experimental Procedure, ¶1, lines 13-16, buffer layer CaF_2 serves as structural template, Results and Discussion, ¶2, lines 1-3).

Williams et al., however, does not teach the beam to be an electron beam.

In the same field of endeavor, Yakshin et al. teaches how electron beam evaporation allows the user to selectively control the energy contribution at every stage of the film growth (see ¶9, lines 6-7).

Williams et al., however, teaches the semiconductor film to be single crystal (see Fig. 3).

In the same field of endeavor, Taniguchi et al. provides motivation for making the CuCl layer single crystal by teaching how a single crystal structure will have better electron mobility than a polycrystalline crystal structure which would make the semiconductor film more effective in operation (see ¶7, lines 1-3).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create single crystal semiconductor films since electron mobility would be greatly enhanced as compared to a polycrystalline structure.

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

Williams et al. also does not teach the irradiation current HI of the electron beam to be 0(microA) < HI <= 150(microA).

In the same field of endeavor, Yamada et al. teaches how thermal degradation can occur when the irradiation current density is 1 A/mm^2 or higher (see col. 9, lines 47-56).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use a electron beam wherein in a given 1 mm^2 of beam area, there is a 1 microA current in that 1 mm^2 of beam area since any irradiation current over 1A/mm^2 will cause thermal degradation as taught by Yamada et al.

With regards to **claim 18**, Williams et al. teaches a process for producing a group I-VII semiconductor crystal thin film on a substrate made from ionic single crystals, comprising:

forming a buffer layer on the substrate, the buffer layer being for alleviating distortion caused due to a difference in lattice constant between the substrate and the group I-VII semiconductor crystal thin film (see Results and Discussion, ¶2, lines 1-3; buffer layer CaF_2 serves as structural template); and

forming, on the buffer layer, the group I-VII semiconductor crystal thin film, the group I-VII semiconductor thin film being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see Experimental Procedure, ¶1, lines 13-16).

Williams et al., however, does not teach the beam to be an electron beam.

In the same field of endeavor, Yakshin et al. teaches how electron beam evaporation allows the user to selectively control the energy contribution at every stage of the film growth (see ¶9, lines 6-7).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to utilize an electron beam evaporation since it allows the user to selectively control the energy contribution at every stage of the film growth.

Williams et al., however, teaches the semiconductor film to be single crystal (see Fig. 3).

In the same field of endeavor, Taniguchi et al. provides the motivation for using single crystal film by teaching how a single crystal structure will have better electron mobility than a polycrystalline crystal structure which would make the semiconductor film more effective in operation (see ¶7, lines 1-3).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create single crystal semiconductor films since electron mobility would be greatly enhanced as compared to a polycrystalline structure.

Williams et al. does not teach the single crystal thin film to be of single composition.

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

Williams et al., however, does not teach the filament current FI of the electron beam to be $0(A) < FI < 5(A)$.

In the same field of endeavor, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to understand that if the irradiation current was 1 mA as taught by Yamada et al. (see **claims 17,19**), then the filament current MUST be no greater than 1 mA since one of ordinary skill would recognize that the current of the filament must be no greater than the irradiation current of the device.

With regards to **claim 19**, Williams et al. teaches a process for producing a group I-VII semiconductor crystal thin film on a substrate made from ionic single crystals, comprising:

forming a buffer layer on the substrate, the buffer layer being for alleviating distortion caused due to a difference in lattice constant between the substrate and the group I-VII semiconductor crystal thin film (see Results and Discussion, ¶2, lines 1-3; buffer layer CaF_2 serves as structural template); and

forming, on the buffer layer, the group I-VII semiconductor crystal thin film, the group I-VII semiconductor thin film being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see Experimental Procedure, ¶1, lines 13-16).

Williams et al., however, does not teach the beam to be an electron beam.

In the same field of endeavor, Yakshin et al. teaches how electron beam evaporation allows the user to selectively control the energy contribution at every stage of the film growth (see ¶9, lines 6-7).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to utilize an electron beam evaporation since it allows the user to selectively control the energy contribution at every stage of the film growth.

Williams et al., however, teaches the semiconductor film to be single crystal (see Fig. 3).

In the same field of endeavor, Taniguchi et al. provides the motivation for using single crystal film by teaching how a single crystal structure will have better electron mobility than a polycrystalline crystal structure which would make the semiconductor film more effective in operation (see ¶7, lines 1-3).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create single crystal semiconductor films since electron mobility would be greatly enhanced as compared to a polycrystalline structure.

Williams et al. does not teach the single crystal thin film to be of single composition.

In the same field of endeavor, Yakshin et al. teaches how a single crystal thin film being a thin film of single composition and being a combination of a layer formed while irradiating the electron beam thereon and a layer formed while not irradiating the electron beam thereon (see ¶37, lines 1-5, 6-14; see ¶9, lines 1-7, one of ordinary skill in the art would have known that a single film can be created with a single composition using electron beam evaporation if so desired).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to create a single film of a single composition while irradiating the electron beam and a layer while not irradiating the electron beam thereon since it has already been made known and demonstrated by Yakshin et al.

Williams et al. also does not teach the irradiation current HI of the electron beam to be 0(microA) < HI <= 150(microA).

In the same field of endeavor, Yamada et al. teaches how thermal degradation can occur when the irradiation current density is 1 A/mm^2 or higher (see col. 9, lines 47-56).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use a electron beam wherein in a given 1 mm^2 of beam area, there is a 1 microA current in that 1 mm^2 of beam area since any irradiation current over 1A/mm^2 will cause thermal degradation as taught by Yamada et al.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAE LEE whose telephone number is (571)270-1224. The examiner can normally be reached on Monday - Friday, 7:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jae Lee/
Examiner, Art Unit 2823

JML

/Khiem D. Nguyen/
Examiner, Art Unit 2823